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ABSTRACT

This paper describes the role of formative evaluation in the development of a museum videodisk project entitled "Earth Over Time," which was sponsored by 15 museums of the Interactive Video Science Consortium. Targeted for 10- to 12-year-old children who have come to the museum with their parents, this earth science videodisk covers plate tectonics, volcanoes, earthquakes, sea floor exploration, and shoreline erosion. A description of the exhibit design problems is followed by discussions of the phases of production--high level design, detailed design, production, and implementation--and the escorted trial technique used for evaluation during the design phases. An example of the evaluation procedure is provided, noting the particular emphasis on four criteria: appeal, comprehensibility, accessibility, and responsiveness. Finally, the implementation formative evaluation process--which utilized videotapes of users, touchscreen records from the computer, and interviews with a sample of users--is described. (4 references) (GL)

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COLLABORATION OF RESEARCHERS AND DESIGNERS PRODUCING A SCIENCE MUSEUM VIDEODISC

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Introduction

This paper describes the role of formative evaluation in the development of a museum videodisc project entitled "Earth Over Time." The term, "formative evaluation," refers to trying out exhibit materials during their formation in order to maximize the appeal and effectiveness of the final exhibit.

"Earth Over Time" is an earth sciences videodisc sponsored by 15 museums of the Interactive Video Science Consortium and produced by Digital Techniques, Inc. In general, the activities and content of the disc encourage acquisition of the concept that the earth is constantly moving and changing and is not simply a solid ball. The videodisc covers plate tectonics, volcanoes, earthquakes, sea floor exploration, and shoreline erosion.

Exhibit Design Problems

Museums are particularly difficult environments for which to develop effective informal learning materials. Museum audiences range widely in age, bring a variety of interests and levels of background knowledge, utilize different learning styles, and approach computer-based exhibits with unequal experience in technology. Exhibits are often expected to maintain the interest of repeat visitors and to hold the interest of a group audience, either in a family or a class. Moreover, museums present stimulating exhibits that compete simultaneously for the visitor's attention, and in some cases, the environment can be noisy and distracting. Thus, the informal environment of the museum is a challenge for designers.

To meet some of these environmental demands, the videodisc designers and consortium advisors of "Earth Over Time" made a series of design decisions. The audience was targeted as 10 to 12 year old children who have come to the museum with other children and their parents or teachers. To interest a range of visitors, scripts used narrators varying in age and gender and presented a human interest viewpoint as well as a direct scientific perspective. Activities and information segments were short and varied. To accommodate different learning styles, a variety of activity formats were utilized: game, simulation, self-paced discovery learning, and receptive expository learning.

However, the remaining design problems did not have easy solutions. There was no basic research that indicated what content and design features would appeal most to our audience. And although a touch screen system is physically easy to use, there was very little research that would guide screen design to assure that users could readily access information. Finally, it was not clearly apparent how to meet the expectations and needs of the target audience nor how to script so that they could understand the scientific information. Thus, testing the disc with the target audience was critically important to designing an effective exhibit.

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Phased Production and Evaluation

Most videodisc projects do not include formative evaluation, because it is felt that one cannot try out the product until the disc is pressed and programmed, but then it is too late for cost-effective changes. This is a misconception. There are a great many things you can learn from people who respond to your design -- on paper. For this videodisc project, a unique collaboration occurred between the designers and researchers in which a phased production and evaluation approach was employed.

The initial phase was a high level design, during which the major content areas were chosen, general descriptions were written about the interactivity and the content, and paper screens were drawn to represent the activity and content. The second phase involved development of a detailed design, based on feedback from the evaluation of the high level design. In the detailed design, draft scripts were written, videotapes were roughly edited to represent what would be seen on screen, and interactivity was more specifically defined on a series of paper and acetate overlay screens.

After the detailed design versions were tested, we moved into the production phase. In some cases, producers will develop a temporary check disc with an operational but unfinished software program for testing during this phase. The consortium did not have the funds to do this, so the final disc was evaluated in the implementation phase in the museums themselves, with museum visitors.

Escorted Trial Technique

The evaluation method used to gather audience feedback during the high level and detailed design phases is called an escorted trial technique. The researcher escorted or walked parents and children through the paper design pages, acting as though she were the computer and videodisc, eliciting comments from users along the way. An observer recorded pathways through the design documents and also all verbal and nonverbal responses to the materials. Through observation of users and some more specific questioning of respondents, we obtained information that facilitated design decisions and guided revisions cost-effectively.

For example, the next page shows the "Continental Puzzle" activity screen from the high level design of "Earth Over Time." Users were given paper cut-outs of continents to move around the screen to try to form Pangea. For this early design, researchers offered users two possible feedback mechanisms if they touched the button, "Compare with scientists' view." One method was an overlay on the whole screen showing the outline of Pangea, and the second was a small picture of the completed puzzle in the lower righthand corner. Users responded to these methods and suggested their own feedback ideas.

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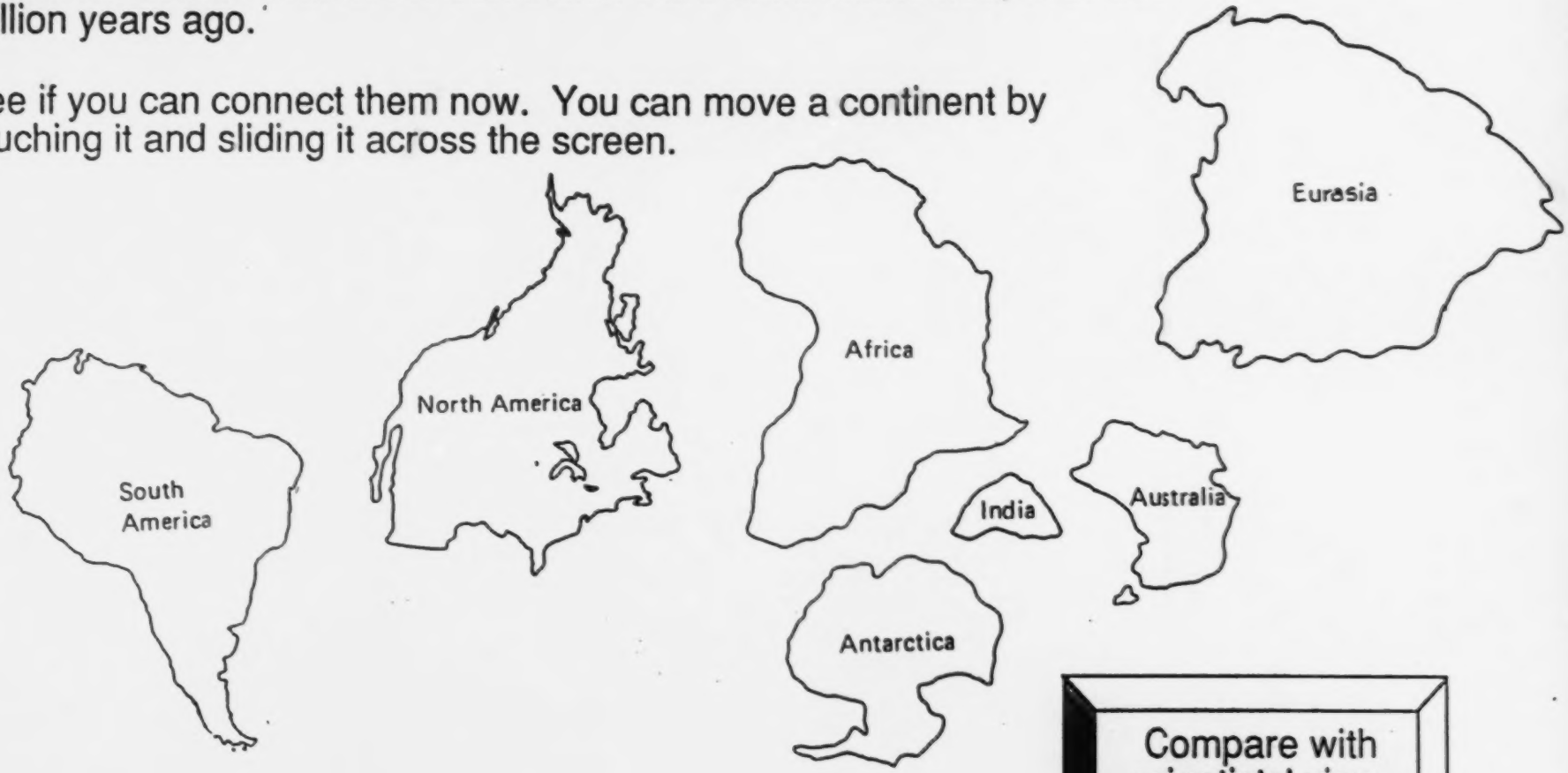
The Continental Puzzle: Pangea (One Earth)

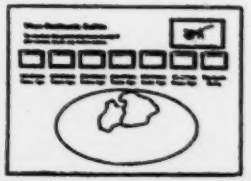
Scientists believe that all the continents were once connected, over 200 million years ago.

See if you can connect them now. You can move a continent by touching it and sliding it across the screen.



Compare with scientists' view.

Other Topics



Colliding Continents

For all the activities, we looked at four issues in the data, although only the "Continental Puzzle" is discussed as an example below:

Appeal. Were the activities fun and interesting? The "Continental Puzzle" received a very positive response, as users huddled around the pieces and got involved in discussions as to where the pieces should move.

Comprehensibility. Did users understand the information available? Did the activity arouse inquiry and curiosity? The puzzle activity elicited a great deal of content discussion, but users wanted a hint or clue, because their ability to produce a close to correct answer was limited to logic or previous knowledge.

Accessibility. Did users know what to do? Did they know what happened if they touched the screen "buttons"? Did they know how to get to another place? Everyone understood the concept of moving the pieces around until they fit, but no one noticed the "Compare with scientists' view" button, because their arms and hands covered it up at the bottom of the screen.

Responsiveness. Are the activities what users expected? What kind of information and feedback do they want or need? What do users want to be able to do? Respondents expected the continents to fit together exactly as puzzle pieces do. In terms of feedback, they wanted to be able to move the pieces while making a comparison with the correct answer or hint, and they wanted the hint to be short.

Based on this feedback, the "Continental Puzzle" activity was redesigned, as were the other activities in the high level design. In the escorted trial technique for the detailed design, the researcher again walked parents and children through the paper design pages, acting as if she were the computer and videodisc. Paper screens and short motion video clips were presented while providing oral narration of what visitors would hear.

To continue our example of the "Continental Puzzle" activity, the detailed design is presented on the next page. Again paper continents were provided to simulate what would happen on the touch screen. In this version, Africa remained immobile, and all continent pieces were to approach Africa. Touching the "Get a Hint" button revealed a black shadow of Pangea underneath the continents -- respondents could continue to move their pieces during the five seconds that the hint was available. Touching "Take a Peek" showed a small completed puzzle of Pangea in the upper righthand corner. "Start Over" repositioned the continents. The researcher gave feedback for positioning of the cut-out paper continents by saying "beep" when the pieces were correct and remaining silent for incorrect positioning.

The same issues of appeal, comprehensibility, accessibility, and responsiveness were considered in the analysis for the detailed design. The puzzle appeal was rated higher for the revised version than for the first version; both parents and students liked the challenge and fun of putting the puzzle together. A large percentage of participants gained a simple definitional understanding of Pangea from doing this activity. Most respondents did not use the clue of "peek," and many suggested that the clues

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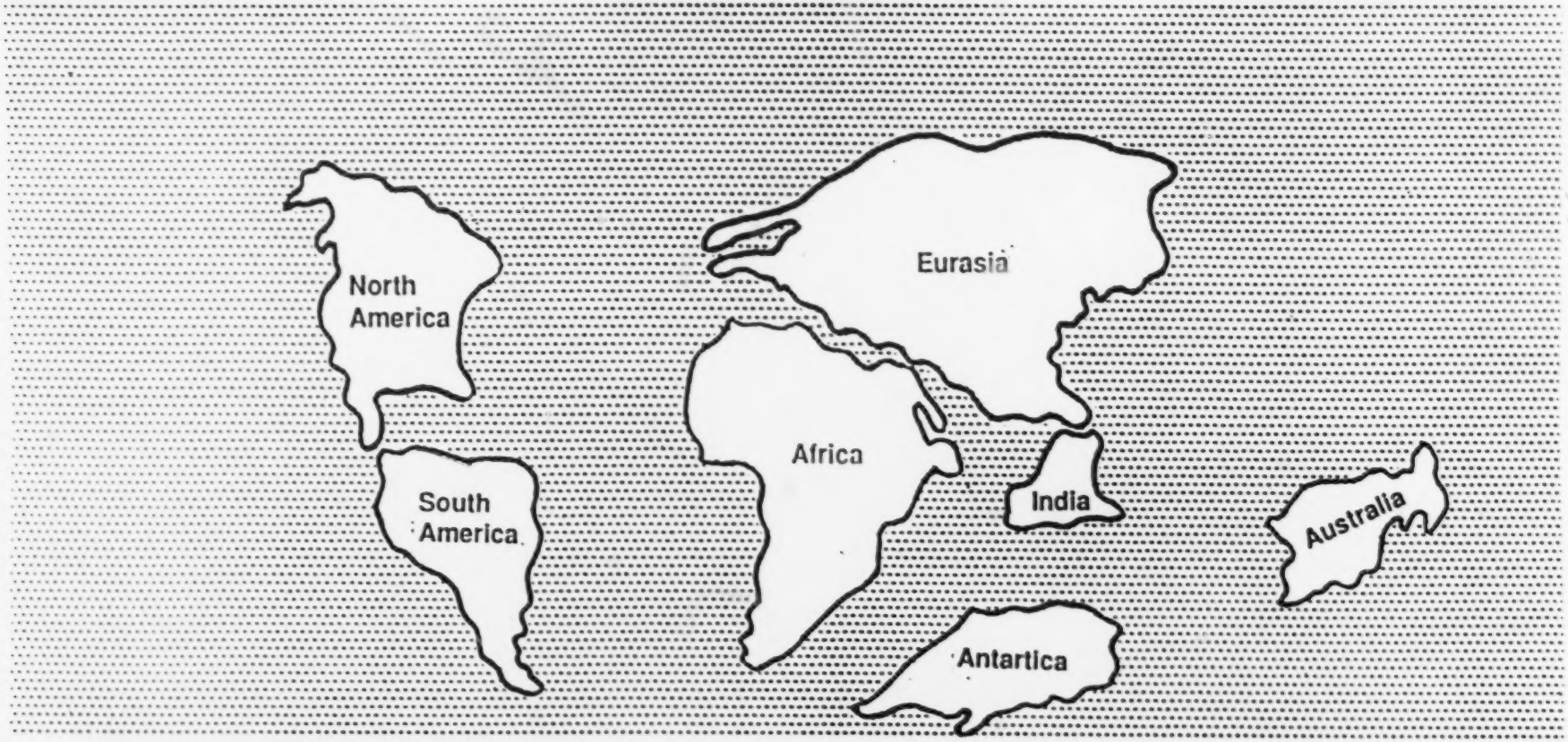
The Continental Puzzle: Pangea (One Earth)

Scientists believe that all the continents were once connected, over 200 million years ago. See if you can connect them now. Move a continent by touching it and sliding it across the screen.

START OVER

GET A HINT

TAKE A PEEK



Time Slider

gave too much information for too long. The audio "beep" was understood by the majority of respondents, although some thought that it meant that time was up or that their move was incorrect. The audio feedback was ambiguous.

The puzzle activity was revised, guided by the evaluation findings. In our example of the "Continental Puzzle," "Get a Hint" was retained whereas "Take a Peek" was dropped (see screen on the next page). The feedback mechanism was changed so that when a continent was moved into correct position next to immobile Africa, its color changed to match Africa and it remained fixed. When all the continents were connected properly, the audio would congratulate the user. The other "Earth Over Time" activities were also revised and the videodisc was pressed and programmed.

Thus, the escorted trial technique with paper designs gathered cost-effective and timely feedback from the target audience. Changes could be made easily without repressing discs or reprogramming software. The formative evaluation was an inexpensive way of increasing the potential that the exhibit would be user-friendly, appealing, and effective. However, even though paper screens can mimic the interactivity of the product, they do not allow testing of the actual touch interface. This has to be done with the hardware itself when it is implemented in the museum environment.

Implementation Formative Evaluation

The data gathered in the museums for "Earth Over Time" included videotapes of users, touchscreen records from the computer, and interviews of a sample of users. These data are in the process of being analyzed now and will answer questions about who used the disc, how it was used, what did they like and learn, and did they have any problems. Fine-tuning of the software program will occur in response to the museum observations.

Conclusion

Formative evaluation allows the target audience to play the role of designer, thereby increasing the likelihood that museum visitors will find the product appealing, educational, and easy to use. For videodisc projects, the escorted trial technique makes it feasible to gather useful and valid diagnostic data from target audiences using early paper designs, before major expenditures are made.

In this particular project, the museum audience, through the evaluation process, played two other roles. One was as a mediating voice in the decision-making of the consortium. The consortium involved 15 museums, each of which had its own agenda in terms of content and design. A number of decisions were made and deadlocks resolved by considering the audience's viewpoint as represented in the evaluations.

A final role of the audience was helping to define the allocation of resources. With a tight budget, cutbacks were designed to retain what the audience found appealing and eliminate the confusing and unappealing segments.

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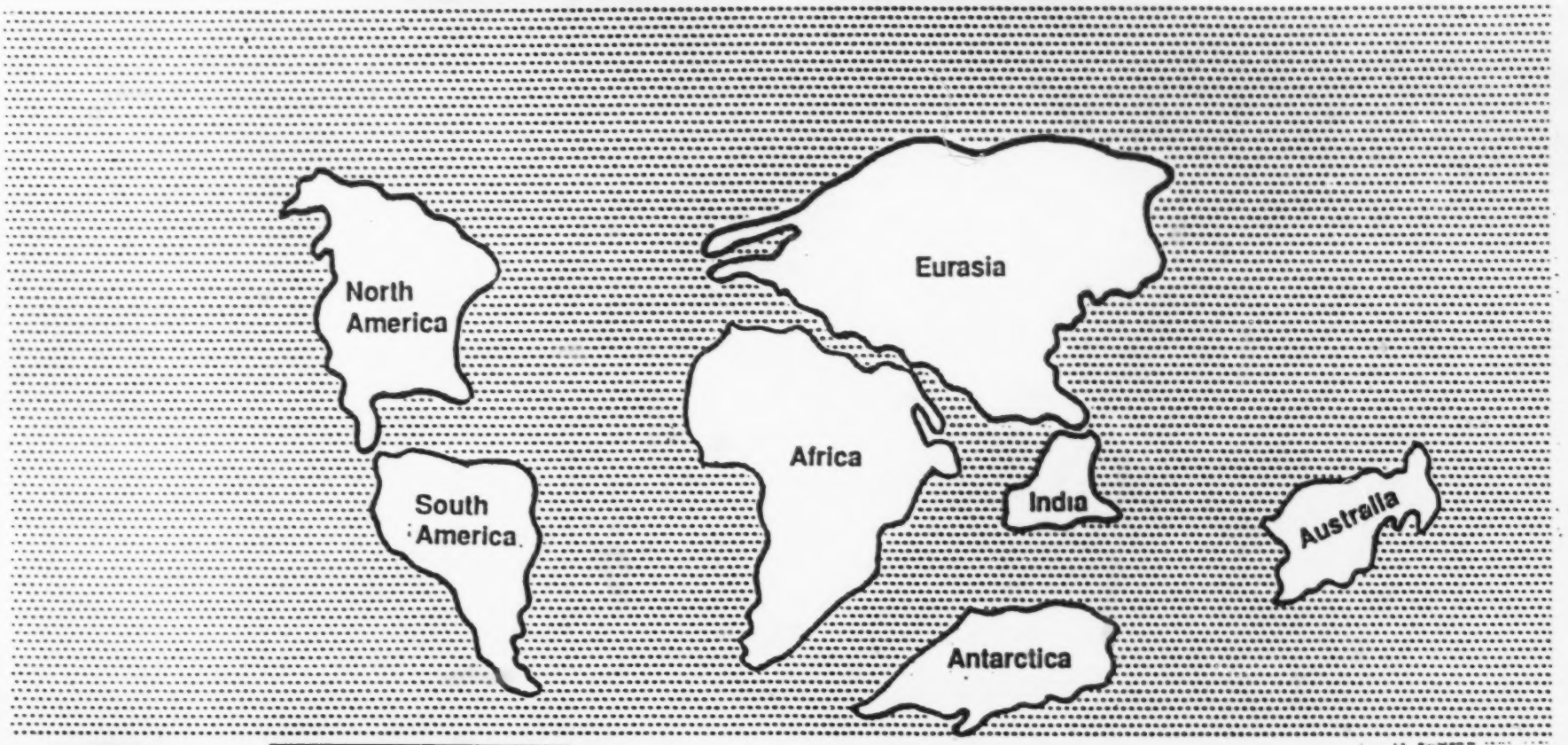
The Continental Puzzle: Pangea

Scientists believe that all land was once connected, over 200 million years ago. See if you can connect the pieces now. Move a land mass by touching it and sliding it across the screen.

START OVER

GET A HINT



Time Slider

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